



REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

PREPUBLICATION

REGULATORY GUIDE 1.149

(Draft was issued as DG-1080)

NUCLEAR POWER PLANT SIMULATION FACILITIES FOR USE IN OPERATOR TRAINING AND LICENSE EXAMINATIONS

A. INTRODUCTION

This regulatory guide describes methods acceptable to the NRC staff for complying with those portions of the NRC's regulations associated with approval or acceptance of a simulation facility for use in reactor operator and senior operator training and NRC license examinations.

In 10 CFR Part 55, "Operators' Licenses," Paragraphs 55.45(a) and 55.45(b) require that an applicant for an operator or senior operator license demonstrate both an understanding of and the ability to perform certain essential job tasks. The operating test will be administered in a plant walk-through and on a simulation facility or on the actual plant if approved by the Commission.

A simulation facility as defined in 10 CFR 55.4 means one or more of the following components, alone or in combination, used for the partial conduct of operating tests for operators, senior operators, and license

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This guide was issued after consideration of comments received from the public. Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience. Written comments may be submitted to the Rules and Directives Branch, ADM, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

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applicants or to establish on-the-job training experience prerequisites for operator license eligibility: (1) a plant-referenced simulator, (2) a Commission-approved simulator in accordance with 10 CFR 55.46(b), or (3) another simulation device, including part-task and limited scope simulation devices approved under 10 CFR 55.46(b).

The requirements for the use of a simulation facility for the administration of the operator licensing operating test are in 10 CFR 55.46, as are the requirements for the use of a plant-referenced simulator for fulfilling a portion of the experience requirements for applicants for operator and senior operator licenses. The requirements for the licensed operator requalification programs, including evaluation, are in 10 CFR 55.59(c)(3) and (4).

The information collections contained in this regulatory guide are covered by the requirements of 10 CFR Part 55, which were approved by the Office of Management and Budget (OMB), approval number 3150-0018. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to the information collection.

B. DISCUSSION

THE ROLE OF SIMULATORS IN OPERATOR LICENSING

Facility licensees are responsible for ensuring that individuals who receive operator or senior operator licenses possess the knowledge, skills, and abilities necessary to operate the facility in a safe manner. In 10 CFR Part 55, Section 55.45, "Operating Tests," requires the applicant for a license to demonstrate (1) an understanding of and the ability to perform the actions necessary during normal, abnormal, and emergency situations; (2) the operation of systems that affect heat removal or reactivity changes; and (3) behaviors that show the individual's ability to function within the control room team in such a way that the facility licensee's procedures are adhered to and that the limitations in its license and amendments are not violated.

The use of a plant-referenced simulator for testing enables the examiner to evaluate a license applicant's performance in a manner that replicates conditions in the plant for which that applicant has applied for a license. When applicants are tested on plant-referenced simulators, major facility differences are minimized between testing and operating environments, and examiners are able to make pass-fail judgments with confidence.

REGULATORY BACKGROUND

In 1981, the industry developed ANSI/ANS-3.5-1981, "Nuclear Power Plant Simulators for Use in Operator Training." ANSI/ANS-3.5 has been revised three times: in 1985, 1993, and 1998.

Regulatory Guide 1.149 has been revised to endorse successive versions of ANSI/ANS-3.5. Exceptions to previous standards in the area of performance testing were specified in the initial issuance through Revision 2 in 1996 of Regulatory Guide 1.149 to ensure that application of previous standards would support the requirements of the regulations and be responsive to the NRC's concern that simulator fidelity must be ensured on a continuing basis.

SIMULATOR PERFORMANCE TESTING

The 1981 version of the standard specified a testing regimen that was written in the context of initial simulator procurement. Until the 1998 revision, the primary focus of the standard was the initial design and construction of the simulator, a unique condition in which extensive factory acceptance testing is performed on the basis of individual simulator capabilities before establishing a software configuration baseline. Except for infrequent simulator replacements and modifications, facility licensees' simulators are now in an update and maintenance phase of the simulator life cycle (an area for which previous revisions of the standard were not intended and for which the standard has offered little specific guidance); these simulators therefore do not need to repeat exhaustive full-scope testing. The type of testing described in previous revisions of the standard provides basic assurance that no noticeable differences exist between the simulator control room and simulated systems, when evaluated against the control room and systems of the referenced unit.

The performance testing formerly specified in 10 CFR 55.45 was suited for a capabilities and schedule-based performance testing program. This requirement is difficult to apply to the process of structured software development coupled with the scenario-based testing that is now fully adopted by the 1998 revision of the standard. The software development and performance testing requirements of ANSI/ANS-3.5-1998, "Nuclear Power Plant Simulators for Use in Operator Training and Examination,"¹ although neither prescriptive nor as extensive as those of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, bring the simulation facility into closer conformance with current industry norms and practices for software quality assurance and training program administration than did the 1985 and 1993 revisions of the standard. The NRC staff considers this improved software development and testing philosophy to be consistent with the NRC's intent that the simulation facility's ability to faithfully portray malfunctions and its general operability are to be verified by periodic performance testing.

In the staff's view, verification and validation testing in the software development process, coupled with scenario-based testing in the training and examination preparation processes, provides additional assurance of acceptable simulator performance over that provided by previous simulator capabilities-based, stand-alone testing programs.

¹ Copies of this standard may be obtained from the American Nuclear Society, 555 N. Kensington Avenue, La Grange Park, IL 60525.

C. REGULATORY POSITION

1. ENDORSEMENT OF ANSI/ANS-3.5-1998

ANSI/ANS-3.5-1998, "Nuclear Power Plant Simulators for Use in Operator Training and Examination," sets forth provisions acceptable to the NRC staff for addressing minimum design, testing, performance, and configuration criteria for a plant-referenced simulator; for integrating simulator design and performance with an accredited training program; for comparing a simulator to its reference plant; for upgrading simulators to reflect changes to reference plant response or control room configuration; and for improving simulator fidelity. ANSI/ANS-3.5-1998 provides methods acceptable to the NRC staff for a facility licensee to demonstrate that, through meeting the criteria of ANSI/ANS-3.5-1998, the plant-referenced simulator will possess a sufficient degree of completeness and accuracy to meet the requirements of 10 CFR Part 55, "Operators' Licenses," for use in reactor operator and senior operator training and NRC license examinations. The following clarifications are applicable to the endorsement of ANSI/ANS-3.5-1998:

1.1 Licensees using a plant-referenced simulator in the conduct of operator licensing examinations after the date of this regulatory guide should meet the applicable requirements of ANSI/ANS-3.5-1998.

1.2 Unless otherwise specifically endorsed by the NRC, other documents referenced in Section 1.2, "Background," of ANSI/ANS-3.5-1998 are not endorsed in this regulatory guide.

1.3 Section 4.4.3, "Simulator Performance Testing," of ANSI/ANS-3.5-1998 requires that a record of the performance test results be maintained, including data comparisons. Section 4.4.3 has a footnote reference to Appendix A, "Guideline for Documentation of Simulator Design and Test Performance," of ANSI/ANS-3.5-1998. Appendix A provides examples that are applicable only to Section 4.4.3.1, "Simulator Operability Testing."

1.4 In regard to Section 4.4.3.2, "Scenario-Based Testing," documentation and performance test results should be consistent with facility licensees' defined objectives of the accredited training program or approved operator licensing operating tests.

1.5 The standard's quality assurance methodology (i.e., verification and validation during software development in a controlled configuration environment with ongoing scenario-based and recurring operability testing) is not expected to be included in the facility's Quality Assurance Program as described in Appendix B to 10 CFR Part 50. Appendix B does not apply to simulation facilities; it applies to nuclear power plants and fuel reprocessing plants, including their structures, systems, and components that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. Appendix B establishes quality assurance requirements for the design, construction, and operation of those structures, systems, and components.

1.6 Editions of ANSI/ANS-3.5 that were previously endorsed by the NRC remain acceptable methods of meeting the regulations.

2. USE OF A SIMULATOR FOR MULTIPLE PLANTS

If a licensee wishes to use a simulation facility to train or examine operators for more than one nuclear power plant, it must be able to demonstrate to the NRC that the differences between the plants are not so significant that they will result in negative training. This demonstration should include an analysis and summary of the differences between each plant, including:

1. Facility design and systems relevant to control room personnel,
2. Technical specifications,
3. Procedures, primarily abnormal and emergency operating procedures,
4. Control room design and instrument/control location, and
5. Operational characteristics.

3. ACCEPTABILITY OF LICENSEE'S SIMULATION FACILITY

Licensees who maintain simulation facilities certified under editions of ANSI/ANS-3.5 that were previously endorsed by the NRC may, but are not required to, revise their software and testing documentation so that the simulation facility will be maintained in accordance with ANSI/ANS-3.5-1998. The NRC expects that a simulation facility will be maintained in accordance with a single revision of the standard.

4. SCHEDULING OF PERFORMANCE TESTING

The scheduling and evaluation of simulation facility testing under ANSI/ANS-3.5-1998 are set forth in Section 4.4.3. of the standard and are considered a function of the facility licensee's accredited training program.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees about the NRC staff's plans for using this regulatory guide.

Except in those cases in which an applicant or facility licensee proposes an acceptable alternative method for complying with the specified portions of the NRC's regulations, the methods described in this guide will be used in the evaluation of the implementation of a facility licensee's simulation facility.

REGULATORY ANALYSIS

A separate Regulatory Analysis has not been prepared for this regulatory guide. A Regulatory Analysis was prepared for the recent amendments to 10 CFR Part 55; this Regulatory Analysis applies to Revision 3 of Regulatory Guide 1.149. A copy of the Regulatory Analysis is available for inspection and copying for a fee at the NRC Public Document Room at 11555 Rockville Pike, Rockville, MD; the PDR's mailing address is USNRC PDR, Washington, DC 20555; telephone (301)415-4737 or toll-free 1-800-397-4209, fax (301)4153548; email PDR@NRC.GOV. Electronic copies of the Regulatory Analysis are available in NRC's Public Electronic Reading Room, which can be accessed through the NRC's web site, <WWW.NRC.GOV> .

**NRC Staff Responses to Public Comments Regarding
Draft Regulatory Guide DG-1080,
“Nuclear Power Plant Simulation Facilities for Use in
Operator Training and License Examinations”**

Draft Regulatory Guide DG-1080, “Nuclear Power Plant Simulation Facilities for Use in Operator Training and License Examinations,” was published for public comment in the *Federal Register* on August 23, 1999 (64 FR 45985). DG-1080 is a proposed Revision 3 of Regulatory Guide 1.149. Comments were received from six facility licensees and one facility training organization. Most commenters expressed support for the proposed revised regulatory guide and the endorsement of the newly revised American National Standards Institute/American Nuclear Society standard, ANSI/ANS-3.5-1998, “Nuclear Power Plant Simulators for Use in Operator Training and Examination.” However, some commenters objected to some of the specific provisions of the draft regulatory guide and others provided specific recommendations for changes. The resolution of public comments is summarized below. This summary addresses the principal comments (i.e., comments other than those that are minor or editorial in nature, supportive of the approach described in the draft regulatory guide, or are applicable to another area or activity outside the scope of the draft regulatory guide).

Comments on “Introduction”

Comment A:

References to 'plant' should be changed to 'unit.' The recent revision of ANSI/ANS-3.5-1998 went to great lengths to make this change, and so should the regulatory guide. Consistent phraseology will minimize conflicts in the interpretation of the regulatory guide and the ANSI standard.

Response: The NRC staff does not agree that it is necessary to replace the term “plant” with the term “unit” in the regulatory guide. The regulatory guide uses phraseology consistent with the regulation. The term “reference plant” is defined in §55.4 as “the specific nuclear power plant from which a simulation facility’s control room configuration, system control arrangement, and design data are derived.” This definition remains the same in the final rule and continues to clarify that for a simulation facility, a specific plant (unit) at a multi-plant (unit) site is the “reference plant.” The NRC staff realizes that the use of inconsistent terminology can be confusing and has made clarifications where appropriate in preparing the final rule. However, the NRC staff intends to re-evaluate the use of the term “reference plant” in the future.

Comment B:

There appears to be some inconsistency between the draft guide and 10 CFR 55.45b. The guide mentions that 10 CFR 55.45b was suited for a different form of testing and is 'difficult to apply' . . . 10 CFR 55.45b still requires a 4 year schedule with 25% of tests run each year, whereas ANSI/ANS-3.5-1998 requires running the steady state and operability tests annually along with scenario testing. 10 CFR 55.45 needs to be revised to conform to the new positions or the regulatory guide should give guidance on the use of ANSI/ANS-3.5-1998 within the context of 10 CFR 55.45.

Response: The staff agrees with the commenter that the performance testing in the current section 55.45 is suited for a capabilities-based and schedule-based performance testing program and is difficult to apply to the process of structured software development coupled with scenario-based testing that is now fully adopted by ANSI/ANS-3.5-1998. In the final rule, Section 55.45(b) has been separated from the requirements for operating tests in Section 55.45 and consolidated in a new Section 55.46, "Simulation Facilities." The requirement for a 4-year schedule with 25 percent of the tests run per year has been deleted.

Comments on "Discussion"

Comment C:

The verification and validation process in software development is the standard procedure for changes to the simulation environment. Scenario-based testing is a new requirement that could add extra burden to the utilities depending upon what the scope of testing is defined to be. Presently, scenarios are tested by instructors to ensure they meet their training objectives, and this aspect is currently a part of the SAT [Systems Approach to Training] process. If a modification is installed into the simulator and is verified to operate as designed for the known set of conditions, the modification should not have to be verified for a variety of scenarios to meet the requirement of scenario-based testing. For the case of adding a containment pressure indicator to one that is already there -- does it have to be tested with a MSLB [Main Steam Line Break], FWLB [Feedwater Line Break], LOCA [Loss of Coolant Accident], with varying degrees of [severities] since they all represent different scenarios with multiple other malfunctions? Additional guidance should be provided to define when a modification has been satisfactorily 'scenario-base tested.'

Response: Editions of ANSI/ANS 3.5 that were previously endorsed by the NRC remain acceptable methods of meeting the regulations. Because adoption of ANSI/ANS-3.5-1998 is voluntary, scenario-based testing is not a new requirement.

The NRC staff agrees that the verification and validation (V&V) process in software development is the standard procedure for changes to the simulation environment, including the commenter's example modification adding a containment pressure indicator. The commenter incorrectly assumes that such changes have to undergo scenario-based testing. As described in Section 4.4.3.2 of ANSI/ANS-3.5-1998, scenario-based testing is associated with scenarios developed for the simulator that need to be tested before their use in operator training or examination. Scenario-based testing is related to the use of fully verified and validated software. Scenario-based testing confirms that the simulator will support training program requirements as described in the lesson plans and learning objectives. The staff agrees that modifications, such as "adding a containment pressure indicator to one that is already there," should not have to be verified for a variety of scenarios to meet the expectations of ANSI/ANS-3.5-1998. The staff does not believe that scenario-based testing will add extra burden. It should be noted that the approach to testing provided in ANSI/ANS-3.5-1998 would offset any potential burden increase resulting from scenario-based testing through reduced requirements for performance testing.

Comment D:

Regulatory Guide 1.149 should not discuss software quality assurance as a description of the current process. The 'software QA [quality assurance]' phrase has meaning in the nuclear industry that is not applicable to simulation software. Use of 'software configuration control and verification/validation testing' or similar wording would be more appropriate for this application.

Response: The NRC staff disagrees that the regulatory guide should not discuss software quality assurance. As stated in the regulatory guide, the term “software QA” refers to the ANSI/ANS-3.5-1998 requirements for V&V during software development in a controlled configuration environment with ongoing scenario-based and recurring operability testing. This meaning is consistent with more general usage of the term in the computer/software industry, that is, quality assurance is the appropriate term for software configuration management and V&V testing. The acceptability of ANSI/ANS-3.5-1998 is based in large part on its provisions for improved software QA. The software development and performance testing criteria of ANSI/ANS-3.5-1998, while not prescriptive with respect to the details of implementation, bring the simulator application into closer conformance with current industry norms and practices for software quality assurance and training program administration than did the 1985 and 1993 versions of the national standard. The NRC staff acknowledges that the phrase “software QA” may have a different meaning in the context of a nuclear power plant than intended by the regulatory guide for a site-specific, plant-referenced simulator. The quality assurance methodology in ANSI/ANS-3.5-1998 is not expected or intended to be included in the facility’s quality assurance program as described in 10 CFR Part 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.” Appendix B does not apply to simulation facilities. Appendix B clearly applies to nuclear power plants and fuel reprocessing plants, including their structures, systems, and components that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. Appendix B establishes quality assurance requirements for the design, construction, and operation of those structures, systems, and components. The final revision of the regulatory guide makes this clear.

Comment E:

Additional guidance should be provided to define when a modification has been satisfactorily 'scenario base tested.'

Response: The NRC staff disagrees with the commenter’s assertion that additional guidance should be provided to define when a modification has been satisfactorily “scenario base tested.” See response to Comment C. Although the regulatory guide is silent in providing specific guidance in this area, the ANSI/ANS-1998 is not. For example, Section 4.4.3.2, “Simulator Scenario-Based Testing,” of ANSI/ANS-3.5-1998 provides sufficient guidance by stating that “the simulator shall be capable of being used to satisfy predetermined learning or examination objectives without exceptions, significant performance discrepancies, or deviation from the approved scenario sequence.”

Comment F:

When modeling is truly performed with the use of first law principles, where matter and energy are fully accounted, scenario-based testing for the sake of validity is unnecessary. Scenario-based testing is only necessary to ensure that the

students are trained on the procedure flow paths that are required for the training objectives.

Response:

The staff agrees that first law principles must be met for models to be valid. However, the complexity of integrated models extends beyond first law principles. The staff believes that scenario-based testing provides additional assurance of the simulator fidelity with the reference plant. The fidelity of simulator modeling is assured through a V&V process as described in the ANSI/ANS-3.5 standard. This assurance is obtained by comparison of simulator performance data with referenced plant design data in either a stand-alone or an integrated manner. Scenario-based testing provides additional assurance of simulator fidelity by ensuring that simulator models that have been thoroughly verified and validated support operator training and/or operator examination objectives in a fully integrated environment. Scenario-based testing does not ensure that operators are trained on the proper procedure flow paths; that is a function of the systems approach to training (SAT) accredited program. Editions of ANSI/ANS 3.5 that were previously endorsed by the NRC remain acceptable methods of meeting the regulations.

Comment G:

If scenario-based testing is required for modeling changes, the regulatory guide should address what reference data would be used to determine the test acceptance criteria. For example, in single failure/malfunction testing, many plant responses are best estimate in that very little actual plant data can be obtained to verify the correct simulator response. Placing several such malfunctions together will only complicate the testing process and make it more difficult to 'test' whether the simulator behavior is correct.

Response: As a point of clarification, as discussed in Sections 4.4.1 and 4.4.2 of ANSI/ANS-3.5-1998, modeling changes are to undergo verification testing and validation testing. The commenter incorrectly assumes that modeling changes have to undergo scenario-based testing. As discussed in Section 4.4.3.2 of ANSI/ANS-3.5-1998, scenario-based testing is associated with scenarios developed for the simulator that need to be tested before use for operator training or examination. Scenario-based testing is related to the use of fully verified and validated software (i.e., simulator models). Scenario-based testing confirms that the simulator will support the training program requirements as described in the lesson plans or learning objectives. That being said, the staff acknowledges that placing several such malfunctions together complicates the testing process and makes it more difficult to determine whether the simulator behavior is correct.

However, the staff believes that reference data can be obtained and that the regulatory guide is appropriately silent regarding what reference data would be used in determining acceptance criteria. Sections 5.1 and 5.1.1 of ANSI/ANS-3.5-1998 list example sources of simulator baseline reference data (e.g., reference unit design data, reference unit performance data, reference unit engineering analyses, simulator supporting calculations and analyses, etc.) Furthermore, acceptance criteria for scenario-based testing can be drawn from learning and examination objectives.

Comment H:

ANSI/ANS-3.5-1998 describes and requires 'Verification Testing' in the software development process, and requires documentation of same. If a utility chooses to upgrade its program to conform to the 1998 standard, would it be required to demonstrate that it met the Verification Testing requirement over the entire life of the simulator software?

Response: If a facility licensee chooses to upgrade its program to the ANSI/ANS-3.5-1998 standard, the verification testing documentation requirements of ANSI/ANS-3.5-1998 would apply from the date of implementation forward.

Comments on "Regulatory Position"

Comments on ?Endorsement of ANSI/ANS-3.5-1998"

Comment I:

The requirements in ANSI/ANS-3.5-1998 provide methods acceptable to the NRC staff for a facility licensee (1) to certify a simulation facility consisting solely of a plant-referenced simulator or (2) to obtain approval of a simulation facility for use in portions of reactor operator and senior operator license examinations, subject to the following clarifications:

- 1.1 Simulation facilities as defined in 10 CFR 55.4, to the extent that the facility licensee applies for approval under the requirements of 10 CFR 55.45(b), should meet the applicable requirements of ANSI/ANS-3.5-1998.*
- 1.2 In Section 1.2, 'Background,' the standard identifies other documents to be included as part of the standard. The applicability of one of these documents, ANSI/ANS-3.1, is covered in Revision 2, Regulatory Guide 1.8, 'Qualification and Training of Personnel for Nuclear Power Plants.'*

Do 1.1 and 1.2 apply to both (1) and (2) above in the preceding paragraph or only to (2)? The structure of the sentence implies that the clarifications apply to only (2).

Response: The requirement in 10 CFR Part 55 for facility licensee certification of plant-referenced simulators has been eliminated. Regulatory Position C.1 in RG 1.149, Revision 3, states, in part, that ANSI/ANS-3.5-1998 provides methods acceptable to the NRC staff for a facility licensee to demonstrate that through meeting the criterion of ANSI/ANS-3.5-1998, the plant-referenced simulator possesses a sufficient degree of completeness and accuracy to meet the requirements of the NRC as described in 10 CFR Part 55, "Operators' Licenses." Thus, clarification 1.1 applies to plant-referenced simulators only. Clarification 1.1 has been revised to read, "Licensees using a plant-referenced simulator in the conduct of operator licensing examinations after the date of this regulatory guide should meet the applicable requirements of ANSI/ANS-3.5-1998." Clarification 1.2 has been revised to read, "Unless otherwise specifically endorsed by the NRC, other documents referenced in Section 1.2, 'Background,' of ANSI/ANS-3.5-1998 are not endorsed in this regulatory guide."

Comment J:

... , 1.1 states that facilities should meet the requirements of ANSI/ANS-3.5-1998. It should be acceptable to meet the requirements of ANSI/ANS-3.5-1993 as an alternative to ANSI/ANS-3.5-1998.

Response: The NRC staff agrees with the comment. RG 1.149 states that editions of ANSI/ANS-3.5 that were previously endorsed by the NRC remain acceptable methods of meeting the regulations.

Comments on "Use of a Simulator for Multiple Plants"

Comment K:

At the beginning of this document I believe it is implied that a facility must first obtain approval for using a simulation facility if it is to be used for testing on a design other than the reference unit. If this is true, then why must a licensee demonstrate to the NRC in its certification that the differences between the plants are not so significant that they have an impact on the ability of the simulation facility to meet the requirements and guidance of ANSI/ANS-3.5-1998 as qualified in this regulatory guide for each of the plants? - keyword is certification - shouldn't the demonstration be made solely in application for approval to use a simulation facility?

Response: The position addressing "Use of a Simulator for Multiple Plants" considers the case in which a facility licensee wishes to use a simulation facility that is designed to simulate a single reference plant (or, using terminology from the ANSI/ANS-3.5-1998, "unit") to train or examine operators of a second or similar plant (unit). Because certification is being eliminated in the final rule, the staff has updated the regulatory guide to clarify that the summary and analysis of the differences between each plant is necessary for the NRC to assess the suitability of the simulation facility for training and examination on plants (units) other than the referenced plant (unit).

In the final regulatory guide, Section C.2, regarding the use of a simulation facility for multiple plants has been revised to reflect that if a facility licensee wishes to use a simulation facility to train and examine operators for more than one nuclear power plant, the facility licensee needs to demonstrate to the NRC that the differences between the plants are not so significant that they will cause negative training. As a point of clarification, ANSI/ANS-3.5-1998, in Section 4.2.1.4, is applicable to deviations between the plant-referenced simulator and its referenced plant rather than differences between the non-reference plant and the referenced plant.

Comment L:

'Significant' should be better explained or defined, and examples given. Without additional guidance NRC inspectors may make individual interpretations that will not promote consistent regulation.

Response: The NRC staff has updated the regulatory guide to clarify that if a licensee wishes to use a simulation facility to train or examine operators for more than one nuclear power plant (unit), it must be able to demonstrate to the NRC that the differences between the plants are not so significant that they will cause negative training. In addition, adequate guidance is provided to NRC inspectors and/or examiners in NUREG-1021, "Operator Licensing Examination Standards for Power Reactors."

Comment M:

The term 'nuclear power plant' should be changed to 'nuclear power plant unit.' If the licensing basis shows that an operator needs to have a multi-unit license for a nuclear power plant with more than one unit, then the simulator, referenced to one unit, should be able to train operators for use on both units. This point is not evident in ANSI/ANS-3.5 (any version), so the clarification provided here is needed. This analysis of the differences between each unit, however, does not seem to align well with ANSI/ANS-3.5-1998 section 4.2.1.4. The additional requirements of DG-1080 need further clarification.

Response: The NRC staff disagrees with the commenter that the term "nuclear power plant" should be changed to "nuclear power plant unit." The rationale of the staff's response to Comment A applies here.

In the final regulatory guide, Regulatory Position C.2, regarding the use of a simulation facility for multiple plants, has been revised to reflect that if a facility licensee wishes to use a simulation facility to train and examine operators for more than one nuclear power plant, the facility licensee needs to demonstrate to the NRC that the differences between the plants are not so significant that they will cause negative training. As a point of clarification, the ANSI/ANS-3.5-1998, in Section 4.2.1.4, is applicable to deviations between the plant-referenced simulator and its referenced plant rather than differences between the non-referenced plant and the referenced plant.

Comments on "Acceptability of Licensee's Simulation Facility"

Comment N:

Licensees whose simulation facilities are currently certified under ANSI/ANS-3.5-1985 should be provided guidance on documenting their review of simulator programs for conformance to an active edition of the standard.

Response: The NRC staff agrees and has updated the regulatory guide to state that licensees that maintain simulation facilities certified under editions of ANSI/ANS-3.5 that were previously endorsed by the NRC may, but are not required to, revise their software and testing documentation, so that the simulation facility will be maintained under ANSI/ANS-3.5-1998.

If a facility licensee chooses to upgrade its program to the ANSI/ANS-3.5-1998 standard, the verification testing documentation requirements of ANSI/ANS-3.5-1998 would apply from the date of implementation forward.

Comments on "Scheduling of Performance Testing"

Comment O:

If this Regulatory Guide is adopted, how would the timetable for simulator testing that was submitted earlier in the facility's Form 474 be addressed?

Response: The final rule amends 10 CFR Part 55 to eliminate the requirement for submitting a testing schedule and quadrennial reports. The staff revised Regulatory Position C.4, "Scheduling of Performance Testing," of the final regulatory guide to address this comment. The regulatory position now points out that the scheduling and evaluation of simulation facility testing under ANSI/ANS-3.5-1998 is a function of the facility licensee's accredited training program. NRC's endorsement of ANSI/ANS-3.5-1998 allows implementation of a testing program that is fundamentally different from that described in earlier versions of the regulatory guide. Simulation facility licensees that use ANSI/ANS-3.5-1998 would be allowed to replace or update their current timetable for simulator performance testing with a schedule that is a function of their accredited training program.

Comment P:

It is recommended that NRC provide interpretation and guidance in the regulatory guide regarding the documentation requirements of ANS-3.5 for scenario-based testing. Reason: The intent of the ANS-3.5 committee was apparently to provide for more realistic and better testing, while at the same time providing for a more cost-effective approach to the periodic testing of simulator performance. However, the documentation requirement of Section 4.4.3, "Simulator Performance Testing," literally interpreted requires the same amount of detailed documentation, as in the past, for both the annual operability test and scenario-based testing. Section 4.4.3 requires data comparison for both, and the user of the standard is referred to Appendix A for acceptable documentation practices applicable for both the annual operability tests and scenario-based testing. The Appendix would require recording of critical parameters and data comparison and documented evaluations for all scenario-based testing. Rather than reduce the burden from the previous malfunction based testing approach, a literal interpretation of the ANS 3.5 documentation requirement, particularly for scenario-based testing, would increase the burden. This is further compounded by the apparent requirement in Section 4.4.3.2, Simulator Scenario-Based Testing, that all scenarios (training, examination, JPM's [Job Performance Measures], etc.) be part of the ANS 3.5 testing program. Since it will be at least 3-4 more years until a revision of ANS 3.5 can be developed that may provide more clarification of the intent of the standard, it is suggested that NRC consider providing clarification in the regulatory guide. NRC may also consider providing clarification of the applicability of the repeatability requirement of the standard (Section 4.1.1) to scenario-based testing.

Response: The NRC staff does not have a response to the commenter regarding the intentions of the ANS 3.5 Standards Committee Working Group (WG) . The commenter's speculations regarding the intentions of the ANS-3.5 WG are not germane to the draft regulatory guide. The revised regulatory guide endorses ANSI/ANS-3.5-1998 because it is an improvement over previous revisions of the standard.

The NRC staff disagrees with the commenter that the documentation requirement of Section 4.4.3, "Simulator Performance Testing," of ANSI/ANS-3.5-1998 requires the same amount of detailed documentation as in the past for both the annual operability test and scenario-based testing. Contrary to the commenter's opinion, the staff's reading of ANSI/ANS-3.5-1998 reveals that the amount of detailed documentation is not addressed by ANSI/ANS-3.5-1998. ANSI/ANS-3.5-1998 provides that a record of the conduct of the simulator performance test and its evaluation shall be maintained. Appendix A only provides an acceptable format for demonstration of a simulator's conformance to the requirements of ANSI/ANS-3.5-1998 and it appears that the intent is that documentation be provided to the extent necessary to form a sufficient basis for verification of simulator performance, configuration control, and maintenance. Clarification 1.3 of the regulatory guide states that Appendix A of ANSI/ANS-3.5-1998 is only applicable to operability testing and not to scenario-based testing. Scenario-based testing documentation should be consistent with the facility licensee's defined objectives of the accredited training program or approved operator licensing examinations.

The NRC staff agrees with the commenter, in part, that Section 4.4.3, "Simulator Performance Testing," of ANSI/ANS-3.5-1998 requires a record of the conduct of simulator performance testing and a comparison showing that the results meet reference unit data for both operability and scenario-based testing. However, it should be pointed out that data comparison for scenario-based testing may be very limited as no actual data may exist for certain scenarios. Section 4.4.3.2, "Simulator Scenario-Based Testing," of ANSI/ANS-3.5-1998 states that the simulator shall be capable of being used to satisfy predetermined learning or examination objectives without exceptions, significant performance discrepancies, or deviation from the approved scenario sequence.

The NRC staff disagrees with the commenter's supposition that "rather than reduce the burden from the previous malfunction based testing approach, a literal interpretation of the ANS-3.5 documentation requirement, particularly for scenario-based testing, would increase the burden." The staff points out that scenario-based testing can, under certain conditions, be credited toward operability testing, which can reduce overall testing requirements. Additionally, as noted above, scenario-based testing documentation need not follow the guidance of Appendix A and, depending on the scenario, may be limited. Because the commenter provides no information or basis to support his comment on this, the staff cannot respond further. The staff also disagrees with the commenter's supposition that an increase in burden is further compounded by the requirements of Section 4.4.3.2, "Simulator Scenario-Based Testing," of ANSI/ANS-3.5-1998, and that all scenarios (training, examination, JPMs, etc.) be part of the testing program. Section 4.4.3.2 of ANSI/ANS-3.5-1998 states that scenarios developed for the simulator shall be tested before use for operator training or examination.

The NRC staff does not agree with the commenter that "clarification of the applicability of the repeatability requirement of ANSI/ANS-3.5-1998 (Section 4.1.1) to scenario-based testing" should be provided in the regulatory guide. Section 4.1.1, "Real Time and Repeatability," of ANSI/ANS-3.5-1998 adequately describes the repeatability expectations of the simulator in that it shall be demonstrated that between successive simulator tests no noticeable differences exist with respect to time-base relationships, sequences, durations, rates, and accelerations. Scenarios that have been tested for use in training or examination of operators are expected to meet this criterion of ANSI/ANS-3.5-1998. It should be pointed out that the initial test conditions

for the conduct of the scenario being tested should be the same as or similar to those initially set up for the scenario.

Comment Q:

ANSI/ANS-3.5-1998 discusses repeatability in the definitions and Section 4.1.1. Specific guidance on what testing requires repeatability and what are acceptable limits of repeatability should be included.

Response: The NRC staff agrees, in part, with the commenter that the ANSI/ANS-3.5-1998 defines the term “repeatability” and that Section 4.1.1, “Real Time and Repeatability,” briefly discusses “repeatability” in the context that it shall be demonstrated that the simulator performs the capabilities defined in Section 3.1, “Simulator Capabilities,” completes execution within the designed time interval, and that the simulation is repeatable. The staff notes that Section 3.1.1, “Real Time and Repeatability,” of ANSI/ANS-3.5-1998 also states that the simulator shall, in a repeatable manner, operate in real time while conducting any of the evolutions required by this section. The staff disagrees with the commenter that specific guidance on which testing requires repeatability and the acceptable limits of repeatability should be included in the regulatory guide. Sections 3.1.1 and 4.1.1 of ANSI/ANS-3.5-1998 adequately describe the repeatability expectations of the simulator by specifying the capabilities for which test repeatability is required and the limits for acceptability in that it shall be demonstrated that between successive simulator tests, no noticeable differences exist with respect to time-base relationships, sequences, durations, rates, and accelerations.

Comment R:

ANSI/ANS-3.5-1998 specifically states that once per year simulator performance testing will be conducted. It also states that performance based testing is comprised of operability and scenario-based testing. Specific tests that can be done by the scenario-based testing are normal evolutions, malfunctions, local operator actions, and other features exercised by the scenario. It appears that all ANSI required malfunctions no longer need to be tested yearly, only those which are used by the scenarios for a given year. This also appears to be an open-ended way to include all malfunctions under the “certification” umbrella, such that any malfunction on the simulator must be certified if it is ever used. There would no longer be a differentiation between the two.

Response: The NRC staff agrees with the commenter that ANSI/ANS-3.5-1998 states, in Section 4.4.3 that simulator performance testing comprises operability and scenario-based testing. Also, the staff is in general agreement with the commenter that simulator operability testing credit, as also discussed in Section 4.4.3.1 of ANSI/ANS-3.5-1998, may be taken for having performed those normal evolutions, malfunctions, local operator actions, and other features exercised by the scenario during scenario-based testing or operator training, provided that certain conditions are satisfied.

Not all of the malfunctions listed in Section 3.1.4 of ANSI/ANS-3.5-1998 need to be tested as part of the operability testing. ANSI/ANS-3.5-1998 provides adequate guidance in Section 4.4.3.1 regarding the testing of malfunctions as part of the simulator operability testing. The revised

regulatory guide points out in Regulatory Position C.4, "Schedule of Performance Testing," that the scheduling and evaluation of simulation facility testing under ANSI/ANS-3.5-1998 are functions of the facility licensee's accredited training program. In other words, the need for scenario-based testing in a given year is based upon the content of the facility licensee's training program. Scenario-based testing may be used to satisfy operability testing requirements when the same function is exercised.

The NRC staff also disagrees with the commenter's opinion that "this also appears to be an open-ended way to include all malfunctions under the 'certification' umbrella, such that any malfunction on the simulator must be certified if it is ever used. There would no longer be a differentiation between the two." The commenter incorrectly infers that there is a "certification umbrella such that any malfunction on the simulator must be certified if it is ever used." Neither the revised regulatory guide nor the final rule require that malfunctions be certified in order to be used on the simulator. In summary, there is no regulatory distinction between "certified" and "non-certified" simulator capabilities, and there never has been. Currently, NRC Form 474, "Simulation Facility Certification," has been utilized to certify that the simulation facility meets the guidance contained in ANSI/ANS-3.5-1985 or ANSI/ANS-3.5-1993, as endorsed by NRC RG 1.149. In other words, the entire simulation facility was certified. In the final rule the requirement for certification is being eliminated.

Comment S:

The new standard allows the use of an accredited training program and license training schedules to perform 25% of the yearly tests. With the new standard the malfunctions, overrides, remote functions, and procedures to be tested are not known until the end of the year. If the scenarios are already tested based upon the scenario-based testing process, the Reg. Guide should specify what would constitute the 25%. One interpretation could be that only 25% of the scenarios have to be scenario-tested for a given year. This should be clarified.

Response: The requirements contained in sections 55.45(b)(4)(vii) and 55.45(b)(5)(vi) have been deleted by the final rule. The scheduling and evaluation of simulation facility performance testing are set forth in Section 4.4.3 of ANSI/ANS-3.5-1998 and are a function of the facility licensee's accredited training program.

Comment T:

... the licensee may reference the licensed operator training schedules of the accredited training program as adequate submittal of a schedule for conduct of approximately 25 percent per year of the performance tests required by 10 CFR 55.45.

We assume, if all scenarios are currently approved, that a complete revalidation is not required. Proper documentation of validation is that they are approved scenarios.

Response: The requirements in sections 55.45(b)(4)(vii) and 55.45(b)(5)(vi) for submittal of a schedule for conduct of approximately 25 percent per year of the performance tests has been deleted from the regulations. The staff disagrees with the commenter's assumption that if all scenarios are currently approved, a complete revalidation is not required, and with the

commenter's assertion that proper documentation of validation is that the scenarios are all approved scenarios. Documentation of scenario-based testing is expected to be a function of the accredited training program. Scenario-based testing confirms that the simulator may be used in its intended manner within the operator training or examination program. The NRC staff expects that facility licensees that opt to maintain their simulation facilities in accordance with ANSI/ANS-3.5-1998 will establish suitable controls to establish an initial software and training application baseline. From that point forward, the documentation requirements of ANSI/ANS-3.5-1998 would apply. A complete "revalidation" of any given scenario may or may not be needed, depending on the acceptance criteria for the scenario in question. Scenario-based performance tests are expected to have proper validation documentation. Scenario-based testing makes use of verified and validated software. Criteria are delineated in the ANSI/ANS-3.5-1998 for validation and testing for whether the simulator behavior is correct. Scenario-based testing, the acceptance criteria, and documentation expectations that are defined in Section 4.4.3.2 of ANSI/ANS-3.5-1998 confirm that the simulator will support the operator training program requirements as described in lesson plans or learning objectives.

Comment U:

The statement is made that the licensee may reference the licensed operator training schedules of the accredited training program as adequate submittal of a schedule for conduct of approximately 25 percent per year of the performance tests required by 10 CFR 55.45(b)(4)(iii) and (vii) and 10 CFR 55.45(b)(5)(vi). Based on this statement, the quadrennial report will not contain a simulator malfunction test schedule. Credit for malfunction testing will be taken by use of the malfunctions in the validated scenarios of the accredited training program. The quadrennial report will only reference the accredited training program schedule.

Response: The requirements in sections 55.45(b)(4)(vii) and 55.45(b)(5)(vi) concerning submittal of a schedule for conduct of approximately 25 percent per year of the performance tests and the requirement for a quadrennial report have been deleted from the regulations, therefore, there is no conflict.

Comment V:

Regulatory Position 4, "Scheduling of Performance Testing," states that the requirements of 10 CFR 55.45(b)(4)(iii) and (vi), and 10 CFR 55.45(b)(5)(vi) related to submitting a report every four years that includes "a schedule for the conduct of approximately 25 percent of the performance tests per year for the subsequent four years," may be met by referencing the licensed operator training schedules of the accredited training program. The commenter believes, that in the long term, less confusion will exist in the industry if 10 CFR Part 55 is modified to delete the reporting and test scheduling requirements.

Response: The staff agrees with the comment because the requirements in sections 55.45(b)(4)(vii) and 55.45(b)(5)(vi) concerning submittal of a schedule for conduct of approximately 25 percent per year of the performance tests and the requirement for a quadrennial report have been deleted from the regulations.

Comments on “Implementation”

Comment W:

Will the NRC permit Reactivity Manipulations to be performed on the simulator, in accordance with 10 CFR Part 55 (proposed change), if a licensee does not adopt the ANSI/ANS-3.5-1998 standard in total?

Response: Yes, facility licensees may permit applicants to perform control manipulations on a plant-referenced simulator provided that the final rule requirements section 55.46(c)(2)(i) and (ii) are met.

Comment X:

. . . has reviewed letter SECY 99-225, 'Rulemaking Plan for Changes to 10 CFR Part 55 to Reduce Unnecessary Regulatory Burden Associated with the Use of Simulation Facilities in Operator Licensing,' and found that the proposed changes to 10 CFR Part 55 would also require a revision to the Draft Regulatory Guide due revised paragraph numbering and deletion of reporting requirements referenced in the Draft Regulatory Guide. If it is the NRC's intent to implement the Regulatory Guide revision concurrent with the rulemaking plan, the Regulatory Guide wording must agree with the proposed text of the 10 CFR Part 55 change. Otherwise, assuming the revision to the Regulatory Guide is effective prior to the changes to 10 CFR Part 55, another revision to the Regulatory Guide must be issued concurrent with the rulemaking plan.

Response: The NRC staff agrees with the comment. The final version of the regulatory guide has been revised to conform with the amended 10 CFR Part 55.